Halophytes and Arc GIS: Tools for Remediating Brine Water Spills in West Texas

ANGELO STATE UNIVERSITY

Department of Physics and Geosciences
San Angelo, Texas

Bond, W.E., Faust M., Dunlap, M., and Ward, J.W..

Abstract

Historic contamination of soils by brine water spills has altered soils, causing them to only be capable of supporting sparse plant life. This complication coupled with soil compaction, and lowered infiltration rates are leading to a decline in forage value throughout West Texas. Concerning this research the primary research location is a 14-acre "kill zone" located on a private ranch approximately 14 kilometers south of San Angelo, Tom Green County, Texas. Five separate halophyte species were planted to evaluate their ability to remediate salt contaminated soils. The species in this study include Distichlis spicata (inland saltgrass), Sporobolus airoides (alkali sacaton), Atriplex canescens (fourwing saltbush), and Cynodon dactylon (common and giant Bermuda grass). These species of specialized plants tolerate elevated levels of salinity. The site has been divided into five sections, each containing 10 of each species of halophyte for a total of 250 test plots. Remote sensing coupled with Google Earth was used to project aerial view maps used to trace the spread of contaminants across the surface since its first appearance. Soil sampling data has allowed modeling of the changes in salt concentrations over the site. Results from the first planting, spring 2015, indicate that protection is needed for plants species as most did not survive. The first planting resulted in most of the test plots being destroyed within the first few months of planting, via drought and animal destruction. Five plots of fourwing saltbush remain and are showing signs of excellent growth in high salinity conditions with an average of 30 cm of growth since the initial planting. Forage quality will be analyzed 2016 along with, solid amendments from ripping and furrowing of the soil, and replanting of our 250 test plots. All of the future data will also be kept in the same ArcGIS database for management purposes

Methodology

- **Perform site analysis and gather soil samples for testing**
- **Gathered data processed through ARCGIS to create surface maps of area and establish Geo databases for region.**
- **Area of study sectioned into five separate regions containing ten of each plant per section for a total of 250 test plots**
- **Monitor plant growth and measure any changes in growth**
- **Soil sampling at end of growing season will be conducted to monitor any changes in salt content**
- **Collect plant material for Hydrochloric dry ash tests to examine nutritional value**

Discussion/Future Work

The results for the 2015 planting season are inconclusive due to destruction of test plots due to weather, erosion, and herbivory by native and livestock species. Cages installed to protect test plots were easily destroyed by cattle. To The 2016 planting season will use the same design for test plot placement with the following techniques implemented:

- Physical Ripping and Furrowing will be implemented to increase permeability and reduce soil compaction. New test plots planted in the 2016 season will be placed down gradient from areas that have been ripped.

- Soil samples will be taken semi-yearly to monitor essential nutrients for optimal plant growth.
- Quarterly surface conductivity testing using EM 38 will be utilized to monitor changes in salt concentrations within the first 3 feet of soil.
- Fencing and additional cages will be installed on site to prevent herbivory by native wildlife and livestock.
- Quarterly testing using D.C. Resistivity, and GEM2 geophysical methods will monitor salt concentrations deeper in the subsurface, as well as characterization of the source of contamination.
- Additional soil samples will be collected and tested onsite to monitor changes in soil pH that could pose a hindrance to optimal plant growth.

Plants

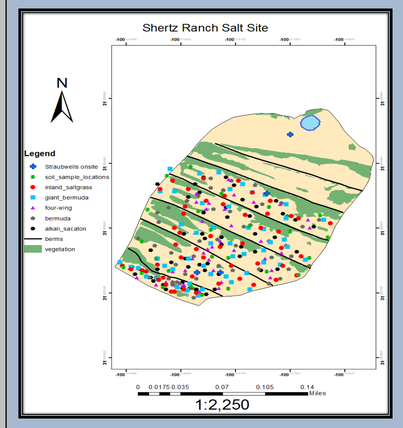
Cynodon dactylon (bermuda and giant bermuda grass):
Bermuda and Giant bermuda grasses have been used in the central valley of California to revegetate salt contaminated agricultural land that is no longer suitable to grow crops, and it has now been repurposed for cattle grazing. Bermuda grass is capable of withstanding drought conditions due to their large root systems.

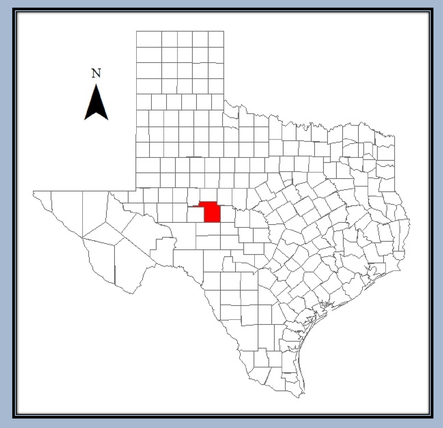
***Sporobolus airoides* (alkali sacaton grass):**
Alkali Sacaton is a native perennial bunchgrass that has been used in extensive riparian zone reclamation throughout the Mojave Desert.

***Distichlis specata* (inland salt grass):**
Inland salt grass is a native plant to west Texas and much of the United States. This perennial grass can survive in a variety of climates ranging from coastlines to deserts.

***Atriplex canescens* (four wing saltbush):**
Four wing saltbush is a native evergreen shrub. This species was selected because of its forage value and salt tolerance.

Area of Study





Site Characterization/Community Education and Service

14 Acre Kill Zone-Shertz Ranch

Time Lapse Aerial Photography 1996-2011

1996

2003

2011

Test Plot Set-Up

References

Available upon request

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